A REVIEW OF HEALTH RELATED ENVIRONMENTAL PROJECTS AND RESEARCH FUNDED BY THE MINISTRY OF THE ENVIRONMENT PROVINCIAL LOTTERY TRUST FUND

1977 - 1981

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1982

Ontario

Ministry
of the
Environment

The Honourable
Keith C. Norton, Q.C.,
Minister

Gérard J. M. Raymond
Deputy Minister

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PROJECTS AND RESEARCH
FUNDED BY THE
MINISTRY OF THE ENVIRONMENT
PROVINCIAL LOTTERY
TRUST FUND
1977 - 1981

HAZARDOUS CONTAMINANTS
AND STANDARDS BRANCH
135 ST. CLAIR AVENUE WEST
TORONTO, ONTARIO M4V 1P5

PROVINCE OF ONTARIO
MINISTRY OF THE ENVIRONMENT

PROGRAM PLANNING AND
EVALUATION BRANCH
1982

PREFACE

This review was compiled from information contained in Ministry of the Environment Provincial Lottery Trust Fund Annual Reports 1, 2 and 3.

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INTRODUCTION

From 1977 through 1980 Environment Ontario committed $7.5 million from proceeds of the Provincial Lottery in support of health related environmental research and development, and removal of health hazards caused by environmental contamination.

Over fifty projects have so far been undertaken with more than twenty completed. The results have already contributed significantly to improved means of pollution control and waste management, and our ability to protect the environment and human health from the effects of contaminants.

The program has aroused widespread scientific and technical interest throughout the Province. Requests for Lottery funding to undertake specific projects come from universities, colleges, research organizations, consulting and contracting firms as well as local governments, citizens and native groups. Proposals are also made by Ministry branch and regional staff.

Many more proposals are put forward that can be assisted, and guidelines and procedures for their evaluation and selection have been established by the Ministry's Research Advisory Committee. Priority is given to those that are practical, cost effective and promise to make a contribution towards the solution of significant and urgent problems of importance to Ontario. Evaluations are made by Ministry and outside experts with the Committee in a coordinating role. The formal decision to fund a project is made by the Minister on the recommendation of the Committee. Less than one-third of proposals received are accepted for funding.

Policy requires that projects be contracted outside the Ministry and limited to a duration of three years. Where proposals have originated with Ministry staff, a contractor or research organization is selected by competitive bidding to perform the work.

Liaison officers are appointed from Ministry staff to maintain and monitor progress. Close contacts are also maintained with Health, Labour and other Ministries and the federal government so that duplication of effort can be avoided; in a number of instances, arrangements for cost sharing have been made.

The Ministry is firm in its belief that the continued development of the program will result in significant technical advances, will assist in defining the economic and health benefits of environmental protection and will economize the costs of pollution control.

SUMMARY OF ALLOCATION OF FUNDS TO AGENCIES

The following three tables show the division of funds between recipient organizations:

I. Origin of the first 162 Proposals Submitted to Environment for Lottery Funding

Proposals Received From	Received	Accepted for Funding*	Under Review
Outside organizations	137	38 (28%)	3
MOE Head Office, Branches and Regions	25	12 (48%)	1
	162	50 (31%)	4

* One project having been accepted was not funded because of budget restrictions.

II. Allocation of Environment Lottery Funds for Grants and Contracts Awarded

For Research By:	No. of Projects	% of Funds Received
Universities & Colleges	24	34.0
Contractors & Consultants	15	26.1
Ontario Research Foundation	3	7.4
Municipalities	4	11.0
For Environmental Clean-Up Purposes:		
Contractors & Consultants	4	21.5
	50	100.0

III. Allocation of Environment Lottery Funds in Grants to Universities

University	No. of Projects	% of Funds
Guelph	3	19.9
Lakehead	3	14.6
Laurentian	2	3.9
McMaster	4	20.6
Ottawa	1	3.3
Toronto	5	8.9
Waterloo	4	9.7
Western Ontario	1	5.5
York	1	13.6
Total	24	100.0

SUMMARY OF ALLOCATION OF FUNDS TO PROJECTS

This information is classified in two ways. Table IV uses a traditional form to relate most of the projects to air, water or land pollution.

IV. Division of Environment Lottery Funds Among Areas of Research

Area of Research	No. of Projects	% of Funds
Air Pollution Abatement	11	21.5
Water (Urban Drainage, Sewage and Drinking)	18	36.2
Land Pollution Abatement	10	16.4
Clean-up of Environment	4	20.5
Medical Investigations	7	5.4
Totals:	50	100.0

Table V distinguishes projects as they relate to health - environmental problem solving, with emphasis on hazardous contaminant concerns as a priority.

V. Division of Environment Lottery Funds Among Areas of Health-Environmental Concern

	Approximate % of Funds
Hazardous Contaminants and Health Effects	42
Management Treatment and Containment of Hazardous Waste	24
Management and Treatment of Drinking Water, Waste Water and Urban Runoff	16
Transportation, Deposition and Interaction of Pollutants and Environmental Management	18
	100

REVIEW OF LOTTERY RESEARCH 1977-1980

This brief review follows the classification of Table V to outline the contributions achieved by Lottery funded environmental research over the first three years of effort. More detailed summaries of each project are provided in the Appendix.

Hazardous Contaminants and Health Effects

The assessment of hazardous contaminants and their health and environmental effects is a field of research growing more complex and critical every year. Lottery funded research has been focussed to obtain a better understanding of risks to health from pollution, particularly for situations in Ontario.

Project No.20 is an important and statistically significant study on air pollution effects undertaken by McMaster University and funded in cooperation with Health and Welfare Canada and the Ontario Ministry of Health. Comprehensive pulmonary tests over three years are being conducted on 3,800 volunteer school children, drawn from the industrial districts and the less polluted residential area above the mountain. The results are indicating a significant correlation between air quality and respiratory morbidity, both outdoor and indoor environments having importance. In a similar connection in project 40, jointly funded with Health and Welfare Canada and the World Health Organization, the Gage Research Institute of the University of Toronto has developed personal pollution monitors for accurate evaluation of indoor and outdoor pollution exposure by individuals. Subjects of known health characteristics are using the monitors under field conditions.

Certain organic chemicals including PCB's are a health hazard. Project 11, now completed, is an inventory of 14 specified chemicals giving Ontario locations for storage and shipping, and losses during manufacture and use. No immediate safety problems were indicated.

Project 3, also completed, concerns the evaluation at Lakehead University of substitutes for the use of PCB's in capacitors. Analytic tests and methods developed and applied to determine the environmental acceptability of replacement chemicals have since been incorporated into international standard procedures.

A new project (49), also at Lakehead University is examining the biological effects of organic compounds commonly discharged in industrial wastes. Project 39 deals with analysis of the hazardous organic components of industrial waste discharges. Project 31 characterizes and identifies organic substances in drinking water. Project 29 has demonstrated the use of fish as biomonitors to detect the discharge of hazardous organics into drinking water supplies. The tests were conducted at two locations on the Grand River, one site downstream of urban and agricultural discharges and the other upstream acting as control.

The toxic mechanism and dose risk of PCB's is largely unknown. A two year project (26) at McMaster

University jointly funded with the Ministry of Labour has confirmed that PCB's can cause changes to the immune system of mice. Project 50 will extend this work into the third year.

Recently new techniques have been developed for the rapid and accurate detection of compounds with mutagenic effects. This characteristic is a signal of possible carcinogenic activity. Project 10, at York University, is a comprehensive study of chemicals or combinations of chemicals from polluted air and water samples, to detect those with mutagenic properties.

Heavy metal contaminants are also receiving attention. The University of Waterloo has conducted a long term study on amounts of lead and cadmium in autopsy samples, which has been assisted through Project 33. The data represent a unique Canadian resource as a baseline for future monitoring and to provide evidence on environmental and occupational factors associated with metal levels and causes of death.

Health and welfare effects of noise, the subject of Project 15 will be of value in developing Ontario government policies and guidelines on noise. Project 47 is investigating the sleep disturbance effect of road traffic noise as determined on subjects in their normal sleeping environment.

Management, Treatment and Containment of Hazardous Waste

This research is mainly concerned with the disposal of waste on land. The knowledge and technology to ensure safe and effective procedures is in need of improvement.

Provincial Lottery funds were used to accomplish a number of technically difficult "cleanup" operations namely:

- replacement of contaminated soil around three secondary lead smelters (Project 1);
- radon gas radiation control measures in Elliot Lake housing properties (Project 7) (jointly with Atomic Energy of Canada and Environment Canada);
- assessment of the problem and cleanup of the PCB spill near Dowling, Ontario (Project 9) (jointly with the Canadian Pacific Railway);

and also to investigate the nature and extent of problems resulting from abandoned mining operations in Ontario (Project 2).

With respect to research an important area has to do with containment of waste in landfills. A team from the University of Waterloo has completed detailed studies (project 16) on the 40 year old landfill at Camp Borden. Funding was shared with Environment Canada. The results have improved our knowledge of rates of decomposition and leachate travel. Models have been developed to assess the condition of other landfilling operations. Project 44 is a follow-up study to develop a model to predict groundwater contamination from proposed landfill sites.

Explosive gas production and migration is another serious hazard of landfilling, which affects adjacent properties and after-use of the site. Project 23 will assist the development of controls on site use.

Another general problem under study is sewage sludge disposal. In the past, large amounts of sludge have been applied to agricultural land, as a soil conditioner and fertilizer. Sludge from urban industrialized areas has become, however, increasingly contaminated with heavy metals which are toxic to plants and affect their food value and this end-use in agriculture has been questioned. Lottery funds have been used to bring to completion a nine year study at the University of Guelph, on the long term effects of application of sludge to land (Project 12). Laboratory experiments coordinated with the field studies have also been supported (Project 13), jointly funded with Environment Canada. Project 46 will pay the cost of a summation report of the field work. The results have been used in the preparation of sludge-use guidelines.

The Ministry of Transportation and Communications has cooperated in an investigation of the environmental health hazards of road oiling (Project 5). The results have been employed to prepare guidelines for road oiling. Water run-off is the main route for transfer of oil residues to road shoulders and ditches. Contaminants include PCB's and therefore should be controlled.

Management and Treatment of Drinking Water, Waste Water and Urban Runoff

Ontario is a leader in the development of efficient water and sewage services and the maintenance of standards essential to maintain public health. Provincial Lottery funds have been used to examine the validity of traditional procedures and the new problems arising from threats to health from hazardous contaminants.

Efficient processes for the removal of contaminating organic substances have been investigated at operating water treatment plants at Bellevile and Brantford (Projects 8 and 21).

Chlorine is the customary disinfecting agent for both drinking water and sewage effluent. New evidence has shown traces of chlorinated contaminants to be formed during the process. Project 27 investigates the use of ozone as an alternative means to disinfect drinking water and will provide cost estimates and operating guidelines for its use. A comprehensive evaluation of the purpose, needs and effects of sewage effluent disinfection is underway in Project 28.

The successful development of an experimental cattail marsh sewage effluent treatment facility at Listowel, Ontario (Project 18) has already attracted much attention.

It is demonstrating possibilities of cost saving and advantages of improved effluent quality and removal of toxic metals and phosphorus. There are now plans for marsh developments in other locations.

The Rideau River Stormwater Management Study (Projects 30 and 37) is a notable example of cooperation between federal, provincial and municipal governments. At the completion of the project in 1983 recommendations will be made for a comprehensive storm-water management plan for the Regional Municipality of Ottawa-Carlton in the drainage area of the Rideau River. The information obtained will support official plans for urban growth and increased recreational use of the river. The findings are expected to assist urban development in other watersheds.

Transportation, Deposition and Interaction of Pollutants and Environmental Management

These technical aspects of environmental/health research have to do with understanding the mechanisms of pollution, and are growing in importance. They are a key to an improved ability to assess risk and achieve cost effective environmental management.

An intensive field study (Project 32) has been undertaken in Hamilton to evaluate the contribution of urban road dust to air pollution. The results will provide an understanding of the relative importance of various types of sources, urban and industrial and serve to develop better control strategies.

Mercury contamination occurs in Ontario far from known point sources, possibly, it was believed, by transportation through the atmosphere and deposition. Project 14 was undertaken to define the importance of this mechanism. The results, showed that deposition rates were low in remote locations and somewhat higher near urban areas.

The accumulation of mercury in fish makes them unsuitable for food. It has been observed that acidic lake conditions increase the levels of absorption. Results from Project 22 were to have given some insight into the mechanism, however, no significant effects were observed under the experimental conditions.

Project 24 has been undertaken to monitor fish populations in acid-stressed Haliburton lakes and assess how seriously the acidification phenomenon is affecting fish populations in central Ontario. The study has identified damage to fisheries and thus confirmed the need for abatement at the source.

Projects 19 and 43, undertaken by Laurentian University, have analyzed lichen and mosses for levels of uranium. Results are being correlated with the extent and proximity of uranium mining operations.

Project 4 was undertaken by the University of Ottawa to detect, enumerate and interpret virus levels in drinking and bathing waters, using locations on the Ottawa River. Project 45 by the University of Toronto is a similar study examining the presence of enteric viruses in swimming areas near Toronto. It is part of a large study funded by Health and Welfare Canada on the incidence of human illness in relation to the contamination of bathing waters by pathogenic organisms.

Project 42, financed jointly with the Ministry of Agriculture and Food and Agriculture Canada, is to develop a centre of expertise at the University of Guelph to develop nonchemical approaches to pest control and effective pest management programs. These techniques appear feasible for control of the onion maggot and possibly the carrot rust fly and weevil.

Under Project 35, improved precipitation samplers for rain and snow sampling have been developed for use in acidic precipitation studies.

Project 41 has employed a special remote sensing technique to define the thermal plume from the discharge of cooling water from the Bruce Generating Station into Lake Huron. This will show how warm water currents from the Station may affect fish habitats.

The University of Western Ontario is making a start on molecular studies of pollution activities under Project 34. This fundamental research is aimed at an understanding of the photochemistry of known organic pollutants.

APPENDIX

DEDICATION OF FUNDS

1977	$5,000,000
1978	$2,500,000
1981	$ 500,000

ANNUAL ALLOCATIONS AND EXPENDITURES OF FUNDS

	ALLOCATION	EXPENDITURE
1977 - 78	$1,000,000	$ 724,800
1978 - 79	$2,100,000	$1,911,400
1979 - 80	$2,700,000	$2,628,300
1980 - 81	$1,800,000	$1,799,800
1981 - 82	$ 900,000	$ 899,900

PROJECT LIST AND COSTS

	BRIEF TITLE	COST ($)
1.	Clean-up around Lead Smelters	83,200
2.	Mine Tailings Survey	94,300
3.	Tests on Dielectric Fluids to Replace PCB's	222,100
4.	Virus Levels in Water	92,600
5.	Road Oiling Hazards	134,000
6.	Spread of Encephalitis	7,910
7.	Radiation Control Measures in Elliot Lake	1,206,100
8.	Reducing Chloroform in Bellville Drinking water	83,900
9.	PCB Clean-up at Dowling	219,500
10.	Mutagen Identification & Assay	365,300
11.	Chlorinated and Aromatic Hydrocarbon Inventory	173,100
12.	Land Disposal of Sewage Sludge	304,300
13.	Lysimeter Studies on Sludge Disposal	104,200
14.	Mercury Deposition from the Atmosphere	235,200
15.	Health & Welfare Effects of Noise	51,400
16.	Sanitary Landfill Investigation	36,200
17.	Hospital Admission Rates and Air Pollution	1,000
18.	Experimental Marsh for Wastewater Treatment	335,300
19.	Uranium in Plants	20,000
20.	Health Effects of Particulates and SO_2	516,400
21.	Removal of Organic Contaminants from Brantford Drinking Water	37,000
22.	Mercury Uptake by Fish	45,500
23.	Gas Production at Closed Landfills	287,500
24.	Fish in Acid-Stressed Lakes	183,800
25.	Chemical Destruction of PCB's	18,100

PROJECT LIST AND COSTS (cont'd)

	BRIEF TITLE	COST ($)
26.	PCB Effects on Disease Susceptibility	50,800
27.	Ozone Disinfection of Drinking Water	214,680
28.	Disinfection of Sewage Effluent	260,700
29.	Biomonitoring of Water Supplies	214,427
30.	Kennedy-Burnett Stormwater Study (see #37)	100,000
31.	Organic Substances in Drinking Water	200,000
32.	Air Pollution from Urban Road Dust	177,000
33.	Lead and Cadmium in Autopsy Material	99,000
34.	Surface Photochemistry of Pollutants	152,000
35.	Tests on Precipitation Samplers	53,598
36.	Perpetual Care Insurance	3,273
37.	Rideau River Stormwater Study (see $30)	650,000
38.	(Project Cancelled)	-
39.	Estimation of Total Organic Chlorine	78,800
40.	Human Exposure to Air Pollution	99,400
41.	Bruce Generating Station Thermal Plume	14,500
42.	Non-chemical Pest Control	237,500
43.	Uranium in Plants Phase II (see #19)	89,700
44.	Leachate Attenuation from Landfills	116,000
45.	Virology Study of Beaches	17,000
46.	Summation of Sewage Sludge Studies (see #12)	11,500
47.	Sleep Disturbance from Traffic Noise	153,000
48.	Aquatic Toxicity Studies - Literature Review	10,900
49.	Aquatic Toxicity Studies (see #48)	170,200
50.	PCB Effects on Disease Susceptibility II (see #26)	62,300

SUMMARIES OF PROJECTS

1 TO 50

PROJECT TITLE: Replacement of Lead Contaminated Soil Around Three Secondary Lead Smelters

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PROJECT NO: 1

PRINCIPLE INVESTIGATOR AND AFFILIATION:

Sheridan Nurseries Ltd., Toronto

OBJECTIVE AND DESCRIPTION:

To replace lead contaminated soil in areas adjacent to three secondary lead smelters in Metropolitan Toronto.

Replacement of the contaminated soil eliminated a potential health hazard.

LOTTERY FUNDING: $ 83,200 **REPORTING DATE:** 1977 (Completed)

PARTICIPATION BY OTHERS: Funds were also supplied by the Secondary Lead Smelters.

PROJECT TITLE:	Environmental Clean-up of Inactive and Abandoned Mining Properties
PROJECT NO:	2
PRINCIPLE INVESTIGATOR AND AFFILIATION:	Ministry of the Environment In-house Project (Pollution Control Branch)

OBJECTIVE AND DESCRIPTION:

To document the location and ownership of all important inactive and abandoned mining operations in the Province.

To determine the environmental impact of specific properties and to make recommendations for remedial measures.

The final Report is titled "The Chemical Characteristics of Mineral Tailings in the Province of Ontario." It documents the nature, extent and seriousness of environmental problems and makes general recommendations for remedial measures.

The work was performed by earth-science students under the direction of a coordinator.

LOTTERY FUNDING:	$ 94,300	**REPORTING DATE:**	1979 (Completed)

PARTICIPATION BY OTHERS: No

PROJECT TITLE:	Bio-accumulation rates, Acute and Chronic Effects of Five New Dielectric Fluids on American Flagfish
PROJECT NO:	3
PRINCIPLE INVESTIGATOR AND AFFILIATION:	G.W. Ozburn Lakehead University, Thunder Bay.

OBJECTIVE AND DESCRIPTION:

To determine bio-accumulation rates of P.C.B. substitutes in brook trout.

To compare the acute (lethal) levels of these products using flagfish.

To evalue their chronic effects on the life cycle of Jordanella.

Four substitution products for P.C.B.'s selected in conjunction with Ontario Hydro were tested to determine their health effects and environmental properties.

The results showed the bio-accumulative properties of the products and their acute and chronic toxicity.

The information is being used along with other data accumulated by Ontario Hydro to determine the acceptability of potential P.C.B. substitutes, and the techniques developed have been accepted for incorporation into international standard procedures.

LOTTERY FUNDING:	$ 222,100	**REPORTING DATE:**	1980 (Completed)

PARTICIPATION BY OTHERS:	Test samples were supplied by Ontario Hydro and other product manufacturers.

PROJECT TITLE:	Detection, Enumeration and Interpretation of Levels of Virus in Drinking Water & Bathing Waters
PROJECT NO:	4
PRINCIPLE INVESTIGATOR AND AFFILIATION:	Dr. S.A. Sattar, Faculty of Medicine, University of Ottawa

OBJECTIVE AND DESCRIPTION:

To provide guidelines to interpret the significance of levels and types of virus in bathing and drinking waters.

To determine levels of virus in the Ottawa River.

To identify types of virus isolated.

Samples of sewage plant effluents, Brittania Beach water and Brittania Water Treatment Plant water were collected and specialized sensitive techniques developed and used to determine numbers and types of virus.

Information has been gained for the interpretation of specific levels of virus particularly for swimming water and to assist Ministry development of guidelines.

LOTTERY FUNDING:	$ 92,600	**REPORTING DATE:**	1980 (Completed)

PARTICIPATION BY OTHERS:	No

PROJECT TITLE: An Investigation of the Environmental Health Hazards Associated with Road Oiling

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PROJECT NO: 5

PRINCIPLE INVESTIGATOR AND AFFILIATION: L.S. Love & Associates, Brampton, Ontario

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OBJECTIVE AND DESCRIPTION:

To determine the nature and origin of materials utilized as "road oil".

To determine the contaminants present in "road oil".

To observe the application of the material and the migration of the contaminants into the environment.

To determine effects on soils, crops, vegetation and aquatic life.

To evaluate potential hazard to human health and the environment.

The final Report is titled "The Environmental Effects of Waste Oil as a Road Dust Suppressant".

Water run-off was found to be the main route for transporting materials from oiling to adjacent road shoulders ditches and water courses. Both lead and PCB's were found in run-off. Dust control effectiveness was lost after six months. Careful control of oil contamination in road oiling is to continue. Waste oils were not found more effective for dust suppression than calcium chloride.

LOTTERY FUNDING: $ 134,000 **REPORTING DATE:** 1979 (Completed)

PARTICIPATION BY OTHERS: Ministry of Transportation and Communications

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PROJECT TITLE: The Spread of St. Louis Encephalitis Through Avian and Rodent Reservoirs

PROJECT NO: 6

PRINCIPLE INVESTIGATOR AND AFFILIATION: J.R. Brown (Deceased)
University of Toronto, Ontario

OBJECTIVE AND DESCRIPTION:

To elucidate the role of rodents on the "endemic" area of Southern Ontario as possible hosts for SLE virus.

To develop a capacity of predicting the spillover point of SLE virus in man. The information will be used in the implementation of the spraying program for the control of mosquitos.

LOTTERY FUNDING: $ 7,910 **REPORTING DATE:** 1977

The Project was not completed because of the death of Dr. J.R. Brown.

PARTICIPATION BY OTHERS: Ministry of Health

PROJECT TITLE:	Radiation Control Measures in Elliot Lake
PROJECT NO:	7
PRINCIPLE INVESTIGATOR AND AFFILIATION:	Atomic Energy of Canada

OBJECTIVE AND DESCRIPTION:

Reduction of radioactivity in affected properties to a level regarded as safe for the residents.

To reduce radon gas levels in properties where radioactivity is above acceptable levels.

To contract for remedial works on about 480 affected properties.

Reduction in health hazards to residents of housing affected.

Work was contracted out by the Atomic Energy Control Board.

This Project will be reported by the Federal Government.

LOTTERY FUNDING: $1,206,100 (Lottery funded portion) **REPORTING DATE:** 1981 (Completed) (Lottery funded portion)

PARTICIPATION BY OTHERS: Atomic Energy of Canada and Environment Canada.

PROJECT TITLE:	Chloroform Reduction Investigation Program at Belleville Utilities Commission
PROJECT NO:	8
PRINCIPLE INVESTIGATOR AND AFFILIATION:	Belleville Utilities Commission, Gore & Storrie Ltd.

OBJECTIVE AND DESCRIPTION:

To examine the laboratory techniques developed by M.O.E. staff for reduction of chloroform production during disinfection of drinking water with chlorine.

The existing plant was altered so that chlorination took place after sedimentation in phase 1 and after sedimentation and filtration in phase 2. Production of chloroform and other haloforms was measured when chlorine was applied following treatment. This was compared to the normal plant effluent treated in the usual manner.

The results of the study can be applied in the design of the new Belleville Treatment Plant extension and can be utilized by other municipalities with similar problems both in Ontario and elsewhere.

LOTTERY FUNDING: $ 83,900 **REPORTING DATE:** 1980 (Completed)

PARTICIPATION BY OTHERS: No

PROJECT TITLE: PCB Clean-up and Assessment Near Dowling, Ontario

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PROJECT NO: 9

PRINCIPLE INVESTIGATOR AND AFFILIATION: Geocon (1975) Ltd.

OBJECTIVE AND DESCRIPTION:

Engineering evaluation/assessment of PCB-soil interaction, potential effect on groundwater and potential health hazard.

Conduct laboratory studies to develop preliminary information on PCB-soil adsorption/desorption characteristics.

Recommend remedial works as required.

A CPR train accident near Dowling, Ontario resulted in the largest individual spill of PCB to the environment in Ontario and threatened ground waters and the local water supply. The Ministry was ordered to evaluate and implement remedial measures at the derailment site.

The information gained was used as a guide to implement the final solution. It will also have widespread use in further contingencies to minimize potential health hazard and in assisting regulatory authorities in developing environmental guidelines.

Cost partly shared with the Canadian Pacific Railway. The "Research" portion of the total funding is $40,000.

LOTTERY FUNDING: $ 219,500 **REPORTING DATE:** 1981 (Completed)

PARTICIPATION BY OTHERS: Canadian Pacific Railway

PROJECT TITLE:	Chemical Identification and Biological Assay of Airborne and Waterborne Mutagens (Carcinogens)
PROJECT NO:	10
PRINCIPLE INVESTIGATOR AND AFFILIATION:	M. Katz and J. Heddle York University

OBJECTIVE AND DESCRIPTION:

To utilize newly developed, rapid, accurate and economical bio-assay techniques to determine the mutagenic activity and carcinogenic potential of polynuclear aromatic hydrocarbons (PAH) and related epoxides, quinones and other oxidation or photo-oxidation products.

To separate and identify by analysis the PAH and other potential carcinogenic organic compounds derived from the particulate matter of the polluted urban environment, from coke oven effluents and from other energy-related sources in air pollution and water pollution samples.

To determine which chemicals or combinations of chemicals are responsible for mutagenic activity.

Chemical separation, identification and analysis of PAH and other organic compounds in samples obtained from polluted air and water were made by techniques of high speed liquid, gas and thin-layer chromatography ultraviolet fluorescence and mass spectrometry, using methods developed by Katz and co-workers. Mutagenic activity was tested singly and in pairwise and multiple combinations by three "in vivo" systems, one bacterial and two mammalian assays, using mice.

LOTTERY FUNDING:	$ 365,300	**REPORTING DATE:**	1981 (Completed)

PARTICIPATION BY OTHERS: No

PROJECT TITLE:	Province-Wide Quantity/Location Inventories and Emission/Discharge Inventories for Specified Chlorinated and Aromatic Hydrocarbons
PROJECT NO:	11
PRINCIPLE INVESTIGATOR AND AFFILIATION:	Acres Consulting Services Ltd.

OBJECTIVE AND DESCRIPTION:

To assess community exposure to hazardous substances belonging to the chlorinated and aromatic hydrocarbon classes of chemicals.

These substances have the potential for causing significant environmental health impact if released and have been designated as requiring immediate attention.

Reports were prepared:

(1) province-wide quantity/location inventories for the specified group of hazardous substances;

(2) emission/discharge inventories for selected substances as high priority identified under (1).

There was no indication that emissions and discharges of the 14 chemicals reported upon approached current preliminary estimates of hazard levels outlined in Ontario guidelines and standards.

LOTTERY FUNDING: $ 173,100 **REPORTING DATE:** 1980 (Completed)

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Disposal of Sewage Sludge on Agricultural Land

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PROJECT NO: 12

PRINCIPLE INVESTIGATOR AND AFFILIATION:
T.E. Bates
University of Guelph

OBJECTIVE AND DESCRIPTION:

To determine the long-term effects of sewage sludge application to agricultural land on the yield and quality of the crops produced, with particular emphasis on heavy metal content.

Sludges resulting from chemical treatment of sewage for phosphorus removal were applied to soils in the field and greenhouse to determine the effect on yield, quality and metal content of crops. Crop yields were measured and plant material and soils analysed for nutrients and metals.

These trials provide information on the effect of sludge on crop yield and quality. In general crop yields are expected to be at least as good as with manufactured fertilizers. Additions of most metals are expected to cause concern regarding the quality of crops for human or animal food at rates that do not adversely affect crop yield.

LOTTERY FUNDING: $ 304,300 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: Project was previously funded by the Canada/Ontario Agreement on Great Lakes Water Quality.

PROJECT TITLE:	Effects of Applying Digested Sewage Sludges to Agricultural Land - Lysimeter Studies

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PROJECT NO:	13

PRINCIPLE INVESTIGATOR AND AFFILIATION:	Rush Engineering Services Ltd.

OBJECTIVE AND DESCRIPTION:

The objective of this study is to define long-term maximum allowable sludge application rates to various agricultural soils growing either forage or edible crops without causing deleterious effects to plant quality, ground water quality, and soil productivity.

A secondary objective is to compare Wastewater Technology Centre (WTC) lysimeter data with University of Guelph field data.

Information so developed can then be incorporated into guidelines or standards which determine with reasonable factors of safety a permissible code of practice. The standards must state clearly the maximum permissible concentrations of toxic or undesirable contaminants in sludge, soil, plants, runoff, and leachate to ground water.

LOTTERY FUNDING:	$ 104,200	**REPORTING DATE:**	1981

PARTICIPATION BY OTHERS:	Environment Canada, Wastewater Technology Centre, on basis of 50/50. Project was previously funded by the Canada/Ontario Agreement on Great Lakes Water Quality.

PROJECT TITLE:	A Study of Atmospheric Mercury Deposition in Ontario
PROJECT NO:	14
PRINCIPLE INVESTIGATOR AND AFFILIATION:	Ontario Research Foundation

OBJECTIVE AND DESCRIPTION:

The primary objective of this study was to collect experimental data on atmospheric levels and deposition rates of mercury at specific locations in Ontario. These results were used to estimate the total deposition flux of mercury to land and water surfaces in urban and rural areas of Ontario, and thus define the relative importance of the atmosphere as a medium for the transport of mercury.

A mobile filed monitoring station was assembled and operated for 6 months in the Toronto and Huntsville areas. Airborne concentrations and deposition rates of mercury, and relevant meteorological parameters required for interpretation of the results were measured. Elemental, organic and particulate mercury components were identified.

The results showed that deposition rates were low in remote locations and slightly higher near urban areas. There was no evidence of a predominant long range transport mechanism. Therefore, atmospheric deposition cannot explain the fact of elevated mercury levels in fish in remote Ontario lakes.

LOTTERY FUNDING: $ 235,200 **REPORTING DATE:** 1981 (completed)

PARTICIPATION BY OTHERS: No

PROJECT TITLE: An Investigation of the Health and Welfare Effects of Noise in Ontario

PROJECT NO: 15

PRINCIPLE INVESTIGTOR AND AFFILIATION: SNC/GECO Canada, Inc., Toronto

OBJECTIVE AND DESCRIPTION:

To supply data on the health and welfare effects of different noise sources in Ontario and to develop a single noise descriptor which adequately describes them.

A comprehensive data base of the health and welfare effects of noise from different noise sources in Ontario.

A description of how these effects vary with noise level.

Extensive social and sound level monitoring surveys were made at 26 sites near railways, highways, industry, and airports in Ontario. An examination of health records could not be conducted effectively for reasons of confidentiality.

Proposals have been made for an improved noise descriptor.

The data base revealed by this study has provided comprehensive information on the health and welfare effects of noise in Ontario.

This information will be of use in developing Ontario government policies and guidelines on noise.

LOTTERY FUNDING: $ 51,400 **REPORTING DATE:** 1980 (Completed)

PARTICIPATION BY OTHERS: No

PROJECT TITLE:	Sanitary Landfill Site Investigation at Canadian Forces Base, Camp Borden
PROJECT NO:	16
PRINCIPLE INVESTIGATOR AND AFFILIATION:	University of Waterloo

OBJECTIVE AND DESCRIPTION:

The objectives of the study have been largely achieved including:

- development and evaluation of improved methods for monitoring leachate contamination;
- comparison and evaluation methods for prediction of groundwater velocity;
- better understanding of the behaviour of inorganic contaminants;
- better understanding of rates and processes of anaerobic decomposition of leachate; biodegradation was found to be rapid;
- evaluation of suitability of digital simulation models for analysis of the patterns of contaminant migration.

LOTTERY FUNDING: $ 36,200 **REPORTING DATE:** 1980 (Completed)

PARTICIPATION BY OTHERS: This Project is jointly funded with Environment Canada who supported it 100% prior to FY 1978/79.

PROJECT TITLE: A study on the Relationship between Hospital Admission Rates for Acute Respiratory Illness and the Air Quality in Several Ontario Cities

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PROJECT NO: 17

PRINCIPLE INVESTIGATOR AND AFFILIATION: Dr. G.J. Stopps, University of Toronto

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OBJECTIVE AND DESCRIPTION:

To establish whether Acute Respiratory Disease varies with Air Quality. The Hospital Admissions for Acute Respiratory Diseases in cities with high air pollution level may correlate with the level of Sulfur Dioxide and Particulate Matter, but no such correlations will be expected from cities with low air pollution level.

These funds pay for Hospital Admission Computer Data from 1976 records to be used in the study.

LOTTERY FUNDING: $ 1,000

REPORTING DATE: 1979 (Report not yet received)

PARTICIPATION BY OTHERS: Air Pollution Data supplied by others in Federal and Provincial Governments

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PROJECT TITLE: Development of an Experimental Marsh Treatment Facility at Listowel, Ontario

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PROJECT NO: 18

PRINCIPLE INVESTIGATOR AND AFFILIATION: Gore & Storrie Ltd.

OBJECTIVE AND DESCRIPTION:

To establish a pilot artificial cat-tail marsh sewage treatment system at Listowel adjacent to the sewage treatment plant to:

- determine the effectiveness of the system for reducing bacteriological contamination, heavy metals and nutrients on a year round basis;
- to assess the cost of establishing and operating a marsh-type sewage treatment system in relation to presently accepted modes of treatment, using wastes with varying degrees of advance treatment and at different loading rates;
- to determine the optimum design for an artificial marsh system, considering both effluent quality and cost factors, including possible need for plant harvesting measures.

The system consists of 7 cells, occupying a total area of 2.5 acres giving flexibility of operation. Both lagoon effluent and effluent from an aerated cell are being monitored. In addition, some of the emergent vegetation cells are channeled to permit plant harvesting. Initial tests show the system to be operating very promisingly and demonstrating substantial reduction in BOD, suspended solids and nutrients.

LOTTERY FUNDING: $ 335,300 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: MOE Southwestern Region, Water Resources Branch, Listowel and Environment Canada. Total Project = $489,340.

PROJECT TITLE: Environmental Study on Uranium and Other Elements in Plants around Ontario Uranium Mines

PROJECT NO: 19

PRINCIPLE INVESTIGATOR AND AFFILIATION: Laurentian University, Sudbury, Ontario

OBJECTIVE AND DESCRIPTION:

To collect lichen, moss and selected water samples in the vicinity of the Elliot Lake mining operations.

To develop the appropriate analytical procedures for the evaluation of the levels of uranium and related elements in the collected samples.

Plant and selected water samples were collected during the late summer and autumn of 1978 along appropriate transects from accessible emission sources. The methods employed to analyse the samples included atomic absorption spectro-photometry, X-ray fluorescence spectrometry and pulse polarographic procedures.

This project has provided baseline data, not previously available, on the levels of uranium and related elements in lichens and mosses. The results have indicated that the element content of lichens and mosses clearly reflect local impingement and atmospheric deposition patterns.

LOTTERY FUNDING: $ 20,000 **REPORTING DATE:** 1980 (Completed

PARTICIPATION BY OTHERS: No

PROJECT TITLE:	Epidemiological Study to Determine the Health Effects of Particulates and SO_2 Level (and other gases)

PROJECT NO:	20

PRINCIPLE INVESTIGATOR AND AFFILIATION:	L.D. Pengelly McMaster University, Hamilton

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OBJECTIVE AND DESCRIPTION:

The purpose of this project is to determine the interrelation of factors in a child's environment which may affect both respiratory symptoms and pulmonary function contributing to respiratory health.

Accurate measurements of pollutants are being made at multiple sites, both indoors and outdoors. In addition, certain aspects of the home environment (i.e. parental smoking, type of cooking system, are being surveyed and integrated with socioeconomic factors which may also affect the prevalence of respiratory illness, such as the quality of the housing, the size and age of the family and the density of dwelling. The respiratory condition of approximately 3,800 school children is being determined by extensive pulmonary function testing.

Measurements of air pollution will produce accurate characterization of the quality of the air which the child breathes. A thorough account of socioeconomic characteristics and respiratory condition will be obtained. It is anticipated that these results will be sufficient both in quantity and quality to define the lower ends of the dose-response curves for the effect of suspended particulates and sulphur dioxide on respiratory symptoms. Use is being made of the personal air pollution monitors developed through Project 40.

LOTTERY FUNDING:	$ 516,400	**REPORTING DATE:**	1982

PARTICIPATION BY OTHERS:	Jointly funded with Health and Welfare, Canada and Ontario Ministry of Health.

PROJECT TITLE: Organic Contaminant Removal from City of Brantford Drinking Water

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PROJECT NO: 21

PRINCIPLE INVESTIGATOR AND AFFILIATION:
Brantford Public Utilities
J.F. MacLaren Ltd., Enviroclean Ltd.

OBJECTIVE AND DESCRIPTION:

To determine the effect of activated carbon on the concentration of organic compounds (with primary emphasis on trihalomethanes) in the finished water at the Brantford Water Plant.

Pilot scale treatment facilities have been operated so as to simulate current operation of the Brantford Water Plant.

This project has demonstrated the feasibility of activated carbon and post-chlorination as a readily adaptable in-plant modification for the purpose of organic removal which would be applicable to many water filtration systems in Ontario and elsewhere.

LOTTERY FUNDING: $ 37,000 **REPORTING DATE:** 1980 (Complete)

PARTICIPATION BY OTHERS: No

PROJECT TITLE:	Effects of pH on Mercury Accumulation by Fish
PROJECT NO:	22
PRINCIPLE INVESTIGATOR AND AFFILIATION:	James F. MacLaren Ltd.

OBJECTIVE AND DESCRIPTION:

The accumulation of mercury in fish makes them unsuitable for food. In earlier experiments it has been observed that acidic lake conditions increase the levels of absorbtion.

Lake water fish and plankton were collected and exposed to mercury in the lake column simulators at the Canadian Centre for Inland Waters laboratory in Burlington and chemical analysis conducted to establish the dependency of mercury uptake on pH.

The general conclusion from the results of the study, is that mercury uptake by fish in acid-stressed waters may not be greater than for those in pH neutral waters. Further, the contribution of methyl mercury to fish from their diet was less than reported values.

LOTTERY FUNDING:	$ 45,500	**REPORTING DATE:**	1980 (Complete)

PARTICIPATION BY OTHERS:	Environment Canada, CCIW, Burlington supplied test equipment and a site for this project.

PROJECT TITLE: The Study of Gas Production and Migration at Closed Landfill Sites

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PROJECT NO: 23

PRINCIPLE INVESTIGATOR AND AFFILIATION: Hydrology Consultants Ltd., Division of Trow Ltd.

OBJECTIVE AND DESCRIPTION:

To provide the Ministry of the Environment with information on patterns of gas production and migration at completed and active sanitary landfills and dumps, as it will affect site after-use and on the use of adjacent lands.

The information will be beneficial for the determination and selection of future uses of waste disposal areas. It will facilitate the efficient use of old landfills, which, due to urban development, now occupy prime areas

Anticipated results;

- Development of a comprehensive state-of-art document on landfill gas production, migration and control and possible problem solutions.
- Development of a data base describing gas production and migration of selected landfill sites in Ontario.
- Development of criteria that may be adopted as guidelines for use by the Ministry of the Environment when regulating completed sanitary landfills.

LOTTERY FUNDING: $ 287,500 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Monitoring Fish Populations in Acid-Stressed Lakes of the Haliburton Region

PROJECT NO: 24

PRINCIPLE INVESTIGATOR AND AFFILIATION:
H.H. Harvey, A.P. Zimmerman
University of Toronto
Zoology Department

OBJECTIVE AND DESCRIPTION:

To determine which fish species are present and in what relative abundance in approximately twenty lakes in Haliburton-Muskoka studied by the Limnology Unit, Water Resources Branch.

To determine the absolute population size, the age and growth rate in 7-8 of the study lakes susceptible to acidification.

To determine the effects of acidification on the maturation and spawning processes in these fish populations.

To determine the effects of acidification on the benthos of the study lakes.

To obtain an assessment of how seriously the acidification phenomenon is affecting fish populations in central Ontario.

To determine, the best methods for rehabilitation/prevention of the acidification effects on the fisheries.

The results have confirmed the damage to the fisheries and the need for abatement of acidic pollution at the source.

LOTTERY FUNDING: $ 183,800 **REPORTING DATE:** 1980 (Complete)

PARTICIPATION BY OTHERS: No

PROJECT TITLE:	The Chemical Destruction of Hazardous Polychlorinated Organic Compounds; A Feasibility Study
PROJECT NO:	25
PRINCIPLE INVESTIGATOR AND AFFILIATION:	J.G. Smith, Department of Chemistry, University of Waterloo

OBJECTIVE AND DESCRIPTION:

To examine the dechlorination of hazardous polychlorinated organic compounds using sodium naphthalenide.

To select reaction conditions which optimize the conversion of organic chlorine to sodium chloride.

To select reaction conditions which minimize the operating costs of the process.

To examine the possibility of "scaling-up" the reaction.

Although model experiments showed that destruction of PCB's did occur, the method appears impractical to use with PCB contaminated transformer oil, which comprises the major bulk of product to be disposed of. The University of Waterloo has applied for a patent on the information resulting from Project No.25.

LOTTERY FUNDING:	$ 18,100	**REPORTING DATE:**	1980 (Complete)

PARTICIPATION BY OTHERS:	The Project received funding by others prior to Provincial Lottery support.

PROJECT TITLE: Increased Disease Susceptibility After PCB Exposure

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PROJECT NO: 26

PRINCIPLE INVESTIGATOR AND AFFILIATION: J. Gauldie, G.D. Sweeney, D.A. Clark, Department of Pathology, McMaster University, Hamilton

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OBJECTIVE AND DESCRIPTION:

Established techniques used in this project represent an extensive collaborative effort between chemistry, immunology and pharmacology.

T cells, B cells, killer cells, suppressor and helper cells and their precursors have been measured in lymphocytes isolated from lymphoid organs from mice, treated with PCB and untreated. Defined PCB isomers including dioxins (TCDD) have been used.

The research has produced a major finding, that exceedingly low doses of TCDD can affect thymus-derived lymphocytes, important in viral protection and in tumor rejection. This has implications for human health protection.

LOTTERY FUNDING: $ 50,800 **REPORTING DATE:** 1981

PARTICIPATION BY OTHERS: The Ministry of Labour pays the second year of this Project for a total of $56,623. Total cost of the two year Project is $107,423.

PROJECT TITLE:	Ozone Application as an Alternative to Chlorine for Drinking Water Disinfection
PROJECT NO:	27
PRINCIPLE INVESTIGATOR AND AFFILIATION:	International Environmental Consultants Ltd.

OBJECTIVE AND DESCRIPTION:

The study will identify and quantify by-products which may be formed in drinking water during ozonation and during ozonation/chlorination to determine the toxicity and potential health hazards in comparison with conventional chlorination processes.

Emphasis will be placed on the effectiveness of the combined ozonation/chlorination process in disinfecting water supplies and the long-term health implications of by-products produced. Cost estimates for the ozonization process will be made.

LOTTERY FUNDING:	$ 214,680	**REPORTING DATE:**	1982

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Effect of Hydraulic Characteristics and Effluent Chlorination on the Incidence of Microorganisms of Public Health Significance in Waters receiving Sewage Treatment Plant Effluents

PROJECT NO: 28

PRINCIPLE INVESTIGATOR AND AFFILIATION: Beak Consultants Ltd.

OBJECTIVE AND DESCRIPTION:

To determine if chlorination results in a significantly lower concentration of pathogenic bacteria than for the case of un-chlorinated effluents.

To investigate those hydrological, water quality and atmospheric conditions that contribute to the natural die-off of pathogenic bacteria in non-chlorinated effluents and their receiving waters.

To determine the need and desirability to use selected pathogenic bacteria in place of indicator organisms as indicators of conditions hazardous to public health in effluents and receiving waters in Ontario.

This project will be investigating six sewage treatment plants and their receiving waters.

It will be determined if chlorination of effluent significantly reduces pathogenic bacteria in comparison with effluents not chlorinated. The natural die-off of bacteria will also be examined.

The results should lead to the development of guidelines and criteria for effluent disinfection in Ontario.

LOTTERY FUNDING: $ 260,700 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Biomonitoring of Public Water Supplies

PROJECT NO: 29

PRINCIPLE INVESTIGATOR AND AFFILIATION: International Environmental Consultants Ltd.

OBJECTIVE AND DESCRIPTION:

Biologically active organic compounds in drinking water were identified and quantified at two selected Grand River sites. Fish were exposed to raw drinking water at one site downstream of urban and agricultural inputs and at a site upstream as control. Biomonitoring was conducted by long-term fish exposure and measurement of organic contaminants uptake. Acute behavioural electronic monitoring was tested for its ability to indicate spill or slow discharges of contaminants.

The feasibility of using fish to monitor drinking water for organics was well demonstrated. Rainbow trout fingerlings exposed to raw drinking water accumulated one third more compounds than measured in water samples extracted using a polymer resin. A total of 22 organics were identified in exposed fish, all close to chemical detection limits.

Largemouth bass respiratory activity monitored electronically did not change during 22 days exposure to raw drinking water. Calibrtion tests with known toxicants (zinc, ammonia, phenol) indicated that concentrations of organics would have to increase to acute spill levels or equivalent to levels measured in final industrial waste discharges before responses could be detected. Direct computer analysis of output data is therefore necessary to make this approach react as a true alarm indicator.

LOTTERY FUNDING: $ 214,400 **REPORTING DATE:** 1981 (Completed)

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Kennedy-Burnett Urban Stormwater Runoff Treatment Study. (Preliminary Part of the Rideau River Stormwater Management Study Lottery Project 37)

PROJECT NO: 30

PRINCIPLE INVESTIGATOR AND AFFILIATION: Regional Municipality of Ottawa-Carleton

OBJECTIVE AND DESCRIPTION:

Impoundment has been widely proposed as a method of urban stormwater treatment but reliable data on its value are lacking. A full-scale field study over three years at the Kennedy-Burnett Pond constructed for the purpose will permit a full assessment.

The information is essential before MOE advocates support for impoundment treatment across the Province.

LOTTERY FUNDING: $ 100,000

REPORTING DATE: 1983
In conjunction with Project No.37

PARTICIPATION BY OTHERS: Partners are the Regional Municipality of Ottawa-Carleton, Environment Canada, City of Ottawa, and City of Nepean.

PROJECT TITLE: Characterization and Identification of Organic Substances in Drinking Water

PROJECT NO: 31

PRINCIPLE INVESTIGATOR AND AFFILIATION: Ontario Research Foundation, Mississauga, Ontario

OBJECTIVE AND DESCRIPTION:

This project will identify and quantify organic compounds in the raw and finished water at two selected sites in Southern Ontario. Seasonal variations in presence and concentrations will be studied.

Compounds will range from volatile polar and non-polar (e.g. acetone and chloroform), medium volatile (e.g. pecticides and phenols), non-volatile (e.g. carbohydrates, aromatic acids) to polymeric material (e.g. humic acids, celluloses).

LOTTERY FUNDING: $ 200,000 **REPORTING DATE:** 1981

PARTICIPATION BY OTHERS: No

PROJECT TITLE:	A study to Evaluate Urban Road Dust as a Source of Suspended Particulates
PROJECT NO:	32
PRINCIPLE INVESTIGATOR AND AFFILIATION:	Ontario Research Foundation, Mississauga, Ontario

OBJECTIVE AND DESCRIPTION:

The reduction of suspended particulate matter concentrations in urban areas has been mainly sought through abatement of industrial emissions. The relative importance of the various sources of pollution has not been made clear. This study aims to determine the contribution of urban dust to particulate matter concentrations in Hamilton.

The effect of different street cleaning methods will be assessed and cost effective dust control strategies developed for use in urban locations.

LOTTERY FUNDING:	$ 177,000	**REPORTING DATE:**	1982

PARTICIPATION BY OTHERS:	Partners in this project are Dofasco, Stelco, Environment Canada and the City of Hamilton. Part of the work on Project No.32 was conducted in FY 79/80 by United Technology and Science, Inc. Total Project cost $452,000.

PROJECT TITLE:	The Identification of "Abnormal" Values of Lead and Cadmium in Autopsy Material of Occupationally Exposed Individuals
PROJECT NO:	33
PRINCIPLE INVESTIGATOR AND AFFILIATION:	University of Waterloo K.S. Brown, W.F. Forbes, W.H. Cherry

OBJECTIVE AND DESCRIPTION:

To provide estimates of tissue cadmium and lead levels that can be considered "normal" for current age-sex groups. These data will serve as a baseline for future biological monitoring of cadmium in kidney and of lead in bone.

To assess how far individuals, who are occupationally or environmentally exposed to cadmium or lead, have elevated tissue metal levels relative to normal levels. The data may lead to an estimate of the maximum lead and cadmium levels in selected human tissues at which there is no evidence of an abnormal cause-of-death pattern.

The factors to be investigated are:

The occupation and place of residence;

sex and age of the tissue donor;

lifetime smoking habit;

cause of death.

LOTTERY FUNDING: $ 99,000 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: The project was recommended by Ministry of Labour but is fully supported by Ministry of the Environment. The project was originally funded by Health and Welfate Canada and received an Ontario Public Health grant.

PROJECT TITLE: Surface Photochemistry of Pollutants

PROJECT NO: 34

PRINCIPLE INVESTIGATOR AND AFFILIATION:
University of Western Ontario
P. de Mayo

OBJECTIVE AND DESCRIPTION:

To establish a fundamental understanding of the photochemistry of organic molecules adsorbed on common surfaces and applied to known pollutants.

To discern whether photochemical techniques may be used to destroy pollutants.

Physical investigations will be conducted using photochemical and other techniques to acquire information about the behaviour and mobility of adsorbed medium-to-large organic molecules include the halogenated aromatics, dioxins, and species capable of generating free radicals.

LOTTERY FUNDING: $ 152,000 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: No

PROJECT TITLE:	Field Evaluation of Event Precipitation Samplers for Use in the 'Acidic Precipitation in Ontario Study.
PROJECT NO:	35
PRINCIPLE INVESTIGATOR AND AFFILIATION:	United Technology and Science Inc. 850 Magnetic Drive Downsview

OBJECTIVE AND DESCRIPTION:

All precipitation event collectors in use or proposed have one deficiency or another. A simple design used in the Sudbury Environmental Study will be improved for use in the acidic precipitation in Ontario Study and may have more general use.

Several types of collectors will be evaluated and recommendations made for the best design for rain and snow sampling under various conditions.

LOTTERY FUNDING: $ 53,598 **REPORTING DATE:** 1981

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Assessment of the Availability and Cost of Providing Off-Site Third Party Liability Coverage Protection from Damage from Disposal Facilities.

PROJECT NO: 36

PRINCIPLE INVESTIGATOR AND AFFILIATION:
G.T.G. Scott
Don Mills, Ontario

OBJECTIVE AND DESCRIPTION:

To ascertain the availability and potential cost of Environmental Impairment Liability Insurance to cover the operation of waste management systems and waste disposal sites.

As a result it will be possible to determine the extent to which insurance cover is available to similar operations Province-wide and the economic impact of making such insurance obligatory.

It is expected to result in a Submission by the MOE Manager of the Insurance Program of complete details of the coverage the underwriters are prepared to provide, together with premium quotations for the two representative operations.

The availability of insurance at economic rates to disposal facility operators will ensure that such operators are in a position to meet claims from persons affected.

LOTTERY FUNDING: $ 3,273

REPORTING DATE: 1980 (In-house report completed)

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Rideau River Stormwater Management Study, Ottawa, Ontario (see Lottery Project 30)

PROJECT NO: 37

PRINCIPLE INVESTIGATOR AND AFFILIATION: Regional Municipality of Ottawa, Carleton
Ottawa, Ontario

OBJECTIVE AND DESCRIPTION:

The Region of Ottawa-Carleton population over 500,000 has undergone considerable urban development. The official plan proposes further population increase, of which 100,000 would be adjacent to the Rideau River.

However, the watershed has already suffered serious environmental damage, through pollution. Certain bathing areas have been closed for some time.

The Regional Municipality will administer this study. The Cities of Ottawa and Nepean and Environment Canada will also contribute in collaboration with the Ministry of the Environment.

The study will recommend a comprehensive stormwater management plan in the drainage area of the Rideau River; it will assist implementation of urban growth projections, it will improve the present poor water quality and allow for better recreational activities. Findings may be applied to other watersheds in the Province.

LOTTERY FUNDING: $ 650,000 **REPORTING DATE:** 1985

PARTICIPATION BY OTHERS: Partners are Regional Municipality of Ottawa-Carleton, Environment Canada, City of Ottawa, City of Nepean. Total Project Cost $1,484,000.

PROJECT TITLE: The Measurement of Total Organic Chlorine in Industrial Wastes.

PROJECT NO: 39

PRINCIPLE INVESTIGATOR AND AFFILIATION: A. Benedek, Department of Chemical Engineering, McMaster University, Hamilton

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OBJECTIVE AND DESCRIPTION:

To find suitable methods for the measurement of Total Organic Chlorine in the different types of environmentally important samples and determine their capability.

To use the preferred method for estimation of the level of Total Organic Chlorine in different types of environmental samples.

The carbon adsorption method for Total Organic Chlorine Analysis has the disadvantage that it is manpower intensive. Two other methods will be examined:

(1) samples containing higher concentrations of halogenated organics oxidized without preconcentration, and then analyzed directly in a microcoulometer;

(2) direct heating of a sample in the presence of copper oxide in the carbon rod furnace of an atomic adsorption spectrophotometer.

LOTTERY FUNDING: $ 78,800 **REPORTING DATE:** 1983

PARTICIPATION BY OTHERS: None

PROJECT TITLE: Effects of Human Exposure to Air Pollution (Assessed by Personal Indoor and Outdoor Monitoring)

PROJECT NO: 40

PRINCIPLE INVESTIGATOR AND AFFILIATION: F. Silverman
Gage Research Institute, University of Toronto

OBJECTIVE AND DESCRIPTION:

Assessment of health effects of air pollution is critically dependent on knowing the ambient degree of exposure accurately. Fixed monitoring stations are not a good means of indicating the exposure of persons varying distances away. A small portable monitor has been developed to measure sulphur dioxide, nitrogen oxides and particulates. This can be used inside and outside and overcomes the problem.

A study of health effects on ninety asthmatics and non-asthmatics is underway.

Studies using personal monitors may lead to more rational air pollution control criteria and identification of significant air pollution sources.

LOTTERY FUNDING: $ 99,400 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: Joint funding from Health and Welfare Canada and the World Health Organization. Total funding $300,000

PROJECT TITLE: Bruce Hydro Electric Thermal Plume Definition Flights

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PROJECT NO: 41

PRINCIPLE INVESTIGATOR AND AFFILIATION:

Intertech Remote Sensing Ltd.
Ottawa, Ontario

OBJECTIVE AND DESCRIPTION:

This study has provided a continuous thermal definition of the total plume at the Bruce Generating Plant as viewed against the ambient Lake Huron temperature on three occasions early in 1980. For each of the three flights at 14,000 ft. passes were performed to image the entire plume. The width of the imaged swath at that altitude is 3.41 nautical miles. The purpose of the high altitude pass is to provide a synoptic view of the plume. In addition to the high altitude flight, Intertech conducted a series of 3,000 ft. flights radially outward from the hot water discharge to ambient lake temperatures. At this altitude the width of the imaged swath is 0.79 nautical miles. The purpose of the low altitude lines was to give maximum thermal detail.

LOTTERY FUNDING: $ 14,500 **REPORTING DATE:** 1980 (Completed)

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Development of Non-Chemical Approaches to Pest Control (Sterile Male Onion Maggot Technique)

PROJECT NO: 42

PRINCIPLE INVESTIGATOR AND AFFILIATION:
F.L. McEwen
University of Guelph, Ontario

OBJECTIVE AND DESCRIPTION:

A facility is under construction for mass rearing and quarantine of insects used for biological control and for mass rearing of insects for sterile male release in integrated pest management programs. About 300 acres of onions on the Keswick Marsh will be used as the test site of a field experiment using sterile onion maggot flies. One year will be required for production of the flies followed by two years of field programs of release.

This method appears feasible for onion maggot and possibly carrot rust fly and carrot weevil.

At the end of the grant period, the University will take responsibility for the further maintenance and operation of the facility.

LOTTERY FUNDING: $ 237,500 **REPORTING DATE:** 1984 or later.

PARTICIPATION BY OTHERS: Ministry of Agriculture and Food and Agriculture Canada.

PROJECT TITLE:	Phase II of an Environmental Assessment Study on Uranium and Other Elements in Lichens and Mosses from Elliot Lake, Ontario
PROJECT NO:	43
PRINCIPLE INVESTIGATOR AND AFFILIATION:	E. Nieboer and E.K. Winterhalder, Laurentian University, Sudbury

OBJECTIVE AND DESCRIPTION:

The study will make a more thorough analysis of data collected in Project 19 and apply more sensitive techniques of measurement to previously collected and new samples.

LOTTERY FUNDING: $ 89,700 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: No

PROJECT TITLE:	Attenuation in Ground Water of Inorganic Contaminants from Sanitary Landfills on Sandy unconfined aquifers. (See Lottery Project 16)
PROJECT NO:	44
PRINCIPLE INVESTIGATOR AND AFFILIATION:	J.A. Cherry, J.F. Barker, E.J. Reardon University of Waterloo, Ontario

OBJECTIVE AND DESCRIPTION:

- To determine the degree of attenuation of a large number of inorganic contaminants in shallow ground water at a selected number of landfills situated on sandy unconfined aquifers.
- To account for the observed patterns of contaminant attenuation. The ultimate aim is to be able to predict the degree of attenuation that will occur at sandy sites at which new landfills may be proposed.

A preliminary framework to account for the attenuation of inorganc landfill-derived contaminants in sandy deposits was developed under Project 16 at CFB Borden, Ontario. A more comprehensive methodology will be developed and tested at two new sites. North Bay and the Woolwich landfill serving the northern part of the Region of Waterloo.

LOTTERY FUNDING: $ 116,000 **REPORTING DATE:** 1983

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Continuation of Funding for the Virology Component of the University of Toronto Epidemiology Study of Bathing Beaches and Recreational Waters.

PROJECT NO: 45

PRINCIPLE INVESTIGATOR AND AFFILIATION: P.I. Seyfried,
University of Toronto, Ontario

OBJECTIVE AND DESCRIPTION:

The Federal Department of National Health and Welfare funded an epidemiological study of Great Lakes beaches and recreational waters concerned with the incidence of human illness in relation to pathogenic organisms in waters. Because funds were underestimated, Lottery funds are being supplied to complete the virology portion of the work.

Evidence has been obtained that sewage treatment plant effluents are point sources of enteric viruses and that conventional treatment practices including chlorination are insufficient for complete virus removal.

LOTTERY FUNDING: $ 17,000 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: Health and Welfare Canada

PROJECT TITLE: Compilation of Summation Report on Nine Years of Research Studies on the Disposal of Sewage Sludge on Agricultural Land.

PROJECT NO: 46

PRINCIPLE INVESTIGTOR AND AFFILIATION:
T.E. Bates,
University of Guelph, Ontario
Agricultural College

OBJECTIVE AND DESCRIPTION:

To summarize the results of nine years of field, greenhouse and laboratory studies on the use of sewage sludge on agricultural land. They have been funded by the Canada/Ontario Agreement on Great Lakes Water Quality (Vols. 1 to 6) and Provincial Lottery funds (Vols. 7 to 9, project 12).

A Summation Report will be prepared covering all previous years of the study, showing average effects and trends over time and interpreting the data with particular emphasis on metal availability over the years.

Annual reports have been prepared and printed on this work and a number of scientific papers have been published. However, a comprehensive summary is required and is best done in 1980/81 when the field work is completed. This research has provided valuable information for the preparation of guidelines for Sewage Sludge Disposal on Land.

LOTTERY FUNDING: $ 11,500 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Investigation of Sleep Disturbance Effects of Road Traffic Noise

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PROJECT NO: 47

PRINCIPLE INVESTIGATOR AND AFFILIATION: S.S. Wilson and Associates
Downsview, Ontario

OBJECTIVE AND DESCRIPTION:

The study will make objective measurement of sleep disturbance from road traffic noise. Noise level limits will be recommended for indoor environments in respect to possible health effects due to sleep disturbance. The significance of subjective assessments of annoyance due to road traffic will also be examined.

LOTTERY FUNDING: $ 153,000 REPORTING DATE: 1984

PARTICIPATION BY OTHERS: No

PROJECT TITLE: Review of Literature and Biological Testing Protocol Required for Multiple Toxicity Evaluation Pertaining to Hazardous Organic Compounds.

PROJECT NO: 48

PRINCIPLE INVESTIGATOR AND AFFILIATION: G.W. Ozburn,
Lakehead University, Thunder Bay

OBJECTIVE AND DESCRIPTION:

This is a project to enable the laboratory at Lakehead University to make preparations for the start up in Fiscal Year 81/82 of Lottery Project No. 49, "Aquatic Toxicity Studies of Multiple Organic Compounds".

Since the priority list of hazardous chemicals is extensive it is important at the commencement of Project No. 49 to have already established the groups of chemicals to be investigated. A portion of Project No.48 will be devoted to a literature review.

LOTTERY FUNDING: $ 10,900 **REPORTING DATE:** 1981

PARTICIPATION BY OTHERS: The M.O.E. Hazardous Contaminants Co-ordinator and Environment Canada are partners in the funding of this Project.

PROJECT TITLE: Aquatic Toxicity Studies of Multiple Organic Compounds

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PROJECT NO: 49

PRINCIPLE INVESTIGATOR AND AFFILIATION: G.W. Ozburn and D.E. Orr,
Lakehead University, Thunder Bay

OBJECTIVE AND DESCRIPTION:

The study will determine the effect of biological concentrations of selected organics commonly discharged in industrial wastes.

The effects of individual industrially related organic compounds on fish reproduction as well as their rates of accumulation and depuration will be determined, together with joint toxicity effects.

Exposure of flagfish to these selected organics will identify concentrations that impair or inhibit egg production, hatching success, fry survival and growth. Bio-concentration factors due to uptake from water will also be determined. Rates of uptake through food will be determined in rainbow trout to establish food chain effects.

Concentrations of industrial organic compounds that produce detrimental effects on fish reproduction and recruitment will be established and levels of organics accumulation that impair or reduce the edibility of sport and commercial fish.

LOTTERY FUNDING: $ 170,200 **REPORTING DATE:** 1984

PARTICIPATION BY OTHERS: This project was supported in FY 80/81 with Bridge funding from Lottery Project No.48. Partners in FY 80/81 were Environment Canada and M.O.E. Hazardous Contaminants Co-ordinator.

PROJECT TITLE: Increased Disease Susceptibility After PCB Exposure (See Project No.26)

PROJECT NO: 50

PRINCIPLE INVESTIGATOR AND AFFILIATION:

OBJECTIVE AND DESCRIPTION:

Project No. 26 gave evidence to confirm the supposition that exposure to PCB's could cause significant observation in the response of immune systems. Project 50 continues the investigation.

A study of the immunotoxicity of different halogenated aromatic hydrocarbons in mice will be extended to relate selective suppression of the generation of killer T cells to susceptibility to viral infections. Purified PCB isomers will be compared to TCDD with respect to their dose-dependent effect on the immune system and susceptibility to herpes and influenza viruses. The T cell subpopulation most sensitive to PCB's and TCDD will be defined.

The findings of a "no effect" dose for TCDD will be pursued for other PCB's and should provide a gradation of toxicity for the isomers of these compounds.

The findings may prove beneficial in defining the extent and limits of altered physiology caused by exposure to these toxins.

LOTTERY FUNDING: $ 62,300 **REPORTING DATE:** 1982

PARTICIPATION BY OTHERS: Ministry of Labour in FY 80/81

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